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Short Communication

Effect of the COVID-19 pandemic lockdown on non-COVID-19 emergency department visits in Eastern France: Reduced risk or avoidance behavior?

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ABSTRACT

Objective: To study the impact of COVID-19 pandemic lockdown on avoided emergency department visits and consequent hospitalizations.
Study design: An observational retrospective design was used to investigate avoided visits and hospitalizations of an departmental emergency department combined with a clustering approach on multimorbidity patterns.
Methods: A multimorbidity clustering technique was applied on the emergency department diagnostics to segment the population in diseases clusters. Global visits and hospitalizations from an emergency department during the 2020 lockdown were put in perspective with the same period during 2019. Using a comparison with the five previous years, avoided hospitalizations per inhabitants during the lockdown were estimated for each diseases cluster.
Results: During the 8 weeks of lockdown, the number of emergency department visits have been reduced by 41.47% and resultant hospitalizations by 28.50% compared to 2019. The retrospective study showed that 14 of 17 diseases clusters had a statistically significant reduction in hospitalizations with a pronounced effect on lower acuity diagnoses and middle-aged patient, leading to 293 avoided hospitalizations per 100,000 inhabitants compared to the 5 previous years and to the 85.8 COVID-19 hospitalizations per 100,000 inhabitants.
Conclusion: Although specific to a regional context of pandemic containment, the study suggest that COVID-19 lockdown had beneficial effects on the crowding situation of the emergency departments and hospitals with avoidance effects primarily link to reduced risks.

1. Introduction

The COVID-19 pandemic has had major impacts on both health systems and social behaviors. The difficulty of detecting the disease [1,2], and controlling its spread has led most countries to implement a full lockdown strategy [3]. Combined with specific instructions and preparations [4], this strategy has been able to slow the growth of the disease in the population [5], allowing hospitals and intensive care units to deal with a manageable number of cases. In France, this strategy resulted in full population lockdown from March 16, 2020 to May 11, 2020 which only allowed the French to go out for 1 h maximum outside each day in a limited perimeter of 1 km except for special cases like essential activities like food shopping or critical work activities. It has been able to constrain the limited the peak of COVID-19 hospital occupation in Intensive Care Unit (ICU) to 138.8% of the original capacity and allowed the reproduction to drop down below 1 (<0.8) [6]. The Aube department in Eastern France, where this study was conducted, was particularly impacted with a peak of 208.8% of the original ICU capacity. However, stalling society in this way has also led to a significant drop in other health conditions observed at hospitals and emergency departments (ED) like trauma [7] or stroke [8,9]. The aim of our study is to quantify and analyze the impact of the lockdown on the patient flow of a regional ED.

2. Material

The database of the emergency department of the General Hospital of

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Troyes (in Eastern France) was analyzed to study trends in admissions during the French lockdown. Troyes's hospital is the largest in the Aube Department, and has one of the most active EDs in France, with 59,407 visits in 2019, resulting in 12,639 hospitalizations. In the first part of the study was an analysis of the number of visits from February 16, 2020 to May 31, 2020, with a distinction between admitted and non-admitted patients, and identification of suspected COVID-19 cases during first examination by the triage nurse. The second part of the study used a comorbidity clustering, applied to the period from May 01, 2017 to April 28, 2019 and described in detail in another paper [10], to group the resultant ICD10 diagnostics (International Classification of Diseases 10th Revision) of the visits by their co-occurrence statistics on patient visits and identify multimorbidity clusters that describe the ED utilization. Using this technique, patient flow in the ED was classified into 17 clusters with coherent health problems based on co-occurrence statistics and expert review of ICD10 diagnostics. These clusters were characterized by their hospitalization counts during lockdown, and during the same period of the years 2015–2019, and by their course over time, in order to estimate the number of avoided encounters, using the whole population of the department (310,000) as a reference. The databases of the firefighters' interventions from January 6, 2020 to July 12, 2020 of the Aube Department was also analyzed as these interventions are directly and causally associated to the ED admissions, particularly for trauma injuries. It was put in perspective with the evolution of the ED visits by identifying their global evolution and the specific type of interventions that had known reduction.

2.1. Ethical statement

This study was in compliance with national legislation regarding epidemiological studies (declaration N°2203674v0, dated July 24, 2018). The study was declared with the national registry of health research under the number N°1113130319.

3. Results

During the 8 weeks of lockdown, 5339 patients visited the ED with 939 (17.59%) suspected COVID-19 cases. The number of hospitalizations was 1385 (25.94%), of which 355 (25.63%) were suspected of COVID-19. Compared to the same period in 2019, when 9123 patients visited the ED with 1937 (21.23%) hospitalizations, the volume of total visits decreased by 3784 (41.47%) and hospitalizations by 552 (28.50%).

As illustrated by Table 1, the overall reduction in hospitalizations for the 2-month period, compared to the previous 5 years, was 205.8 (31%) per 100,000 habitants. The age of the population increased significantly (Student's t-test, $p = 1.1E\text{-}17 < 0.05$) from 56.8 ± 28.5 to 62.4 ± 25.7 years. Except for clusters 14, 15, 16, all clusters had a significant change in their daily volumes (Student's t-test, $p < 0.05$). This development was positive for clusters 1 to 15, with a total of 293 avoided hospitalizations per 100,000 inhabitants. Cluster 15 (Rare diagnostics) and 17 (confirmed COVID-19 cases) were the only ones with increased volumes, at 1.9 and 85.8 per 100,000 inhabitants. The 3 most affected clusters (clusters 1, 2, 3) by this reduction were trauma cases involving limbs; with a reduction of more than 85% each, resulting in a total of 27.2 avoided visits per 100,000 inhabitants. Except cluster 6 with a 61%, the other trauma clusters were less affected, with a 44% reduction for cluster 9 and a non-significant 20% and 18% reduction for cluster 14 and 15, resulting in 15.4 avoided visits per 100,000 inhabitants. Cluster 4 (undiagnosed) and cluster 5 (infectious diseases other than COVID-19) were also greatly affected, with a decrease of 75% and 51% respectively, resulting in 35 avoided visits per 100,000 inhabitants. Cluster 10 to 14 characterized by more severe health problems were less affected with reductions from 20% to 43% accounting for 123.6 avoided visits per 100,000 inhabitants.

Initial COVID-19 suspicions could be found in clusters 5, 8, 10, 14 with frequencies of 0–10%; in clusters 7, 12, 13 with frequencies of 10%–25%; in cluster 17 with a frequency of 55.26%.

The number of weekly interventions from firefighters drop significantly (Student's t-test, $p = 2.72E\text{-}3$) from a baseline of 167.66 ± 21.18 interventions outside the lockdown period to 140.88 ± 16.92 interventions during the 8 weeks of lockdown. This corresponds to drop of 26.79 interventions per week (15.98%) or 214.32 interventions for the 8 week period. Using the classification of intervention type used in the database, 11 types out of 99 were identified as having a significant change in their weekly volumes. 7 types of traffic were found, namely "accident with two wheels against two wheels", "two wheels alone", "car against two wheels", "car against car with incarceration", "car against car without incarceration", "car alone without incarceration" and "pedestrian accident against car". These types of accidents had a drop of 11.5

Table 1
Trends in hospitalizations in each cluster of the ED patient flow from 16 march to 11 may.

Name of cluster	ED Hospitalizations mean 2015–2019 (/100K inhab)	ED Hospitalizations 2020 (/100K inhab)	Avoided Hospitalizations (/100K inhab)	Age mean 2020 ± SD
1: Shoulder and arm trauma	8.1	1.0	7.2 (88%)	91.0 (+-4.4)
2: Hand and Wrist Trauma	8.6	1.3	7.3 (85%)	45.2 (+-18.5)
3: Lower limb trauma and hemopathy	10.5	1.6	8.8 (85%)	68.6 (+-29.5)
4: Undiagnosticed	13.2	3.2	9.9 (75%)	71.4 (+-27.1)
5: Mental disorders and at-risk behaviours	71.9	21.9	50.0 (70%)	50.1 (+-30.0)
6: Cutaneous infections and wounds	8.3	3.2	5.0 (61%)	35.1 (+-21.6)
7: Infectious diseases (other than COVID-19)	47.7	23.5	24.1 (51%)	43.0 (+-31.8)
8: Digestive disorders, pregnancy, menstruation	104.6	55.5	49.1 (47%)	54.4 (+-27.7)
9: Head Trauma	18.9	10.6	8.3 (44%)	53.5 (+-31.6)
10: Spine disorders	16.5	9.4	7.2 (43%)	65.8 (+-21.0)
11: Arthropathies	10.1	6.5	3.7 (36%)	70.0 (+-27.3)
12: General symptoms and mental disorders	131.5	84.2	47.4 (36%)	61.5 (+-27.8)
13: General symptoms of chronic conditions	197.3	134.5	62.8 (32%)	69.5 (+-20.5)
14: Chest trauma and at-risk behaviours	12.5	10.0	2.5 (20%)	65.2 (+-23.0)
15: Occulomotor disorders	3.2	2.6	0.6 (18%)	40.4 (+-35.2)
16: Rare diagnostics	1.9	3.2	−1.4 (−72%)	63.5 (+-24.9)
17: COVID19 confirmed cases	0	85.8	NA	66.6 (+-19.5)
Total	659.0	453.2	205.8 (31%)	62.4 (+-25.7)

ED, emergency department; inhab, inhabitants; SD, standard deviation.

interventions per week (67.65%). Other types of intervention were "Collapse without serious symptoms on public place" (drop of 5.88 interventions per week, 31.99%), "Light injured person on public place" (drop of 7.10 interventions per week, 50.34%), "Unconscious person" (drop of 5.42 interventions per week, 36.47%), "Person not answering to phone" (rise of 5.13 interventions per week, 32.85%).

4. Discussion

Our results show a clear change in ED utilization during the period of lockdown, with a greater reduction in the volume of non-hospitalized cases, indicating a reduction in non-urgent or inappropriate visits. Furthermore, hospitalized cases were characterized by a greater reduction in limb trauma, undiagnosed cases and middle-aged patients, indicating a greater reduction in cases with low acuity, and an overall risk reduction effect due to lower activity among the active population. These decreases in trauma cases are line with the types and the number of firefighters 'interventions change and with the findings of Christey et al. [7] who found a reduction of 43% in all injury-related admissions. The relative stability of life-threatening conditions (cluster 12 to 14), indicate that dangerous avoidances of health services for appropriate and necessary hospitalizations were not too dramatic. The absence of this avoidance effect is made possible by the containment of the pandemic in the Aube department, but this was not the case everywhere in France [9].

The reduction in cluster 7 (non COVID-19 infectious diseases) can be explained by a decrease in incidence and in inappropriate use, but perhaps also by underreporting of cases due to the similarity of symptoms to those of COVID-19, which is difficult to distinguish from other diseases in non-severe cases [2]. This difficulty was apparent, since almost one half of patients (38.39 patients per 100,000 inhabitants) who had confirmed COVID-19 diagnostics were not initially suspected of COVID-19, and 7 clusters had suspicions without confirmation, corresponding to a total of 61.61 per 100,000 inhabitants.

4.1. Limitation

Using comorbidity clusters, this study gives more detailed insights into the impact of COVID-19 on trends in admissions. The main limitation of this study is that the effect sizes studied here are specific to a region of France with low population density. This should be put in perspective with the wide regional variations in COVID-19 cases, which are the primary cause of current hospital crowding [6]. However, the avoidance effect on other cases could result primarily from the risk reduction due to lockdown rather than from any fear of consulting that would affect mostly patient with long-term, chronic and degenerative health conditions. Another limitation is the absence of control group, due to the wide spread of COVID-19 and the nature of the lockdown, which was implemented simultaneously across all of France.

4.2. Conclusion

The COVID-19 pandemic and lockdown in French drastically changed the access to healthcare and ED-attendance behaviors. The rise in diagnosed COVID-19 cases, depending on the regional context, and the reduction in all other cases, due to a reduced risk and more appropriate visits, were the main consequences of this situation. Although the ICU capacities were saturated, requiring an important increase in the number of ICU beds, regions where the pandemic was kept under control must have experienced a substantial reduction in ED flow as a beneficial, albeit temporary side-effect of lockdown. However, this beneficial side-effect is contrasted with the adoption of heavy sanitization protocols to avoid the transmission of the virus inside the ED and the hospital, which prevented ED resources from being freed-up. Lockdown policies should communicate on these protocols in the ED department to make them more efficient and to control the risk of cluster growth in hospitals.Furthermore, even though harmful healthcare avoidance behaviors were restricted, lockdown policies should also be supported by an active pedagogy for the public to limit these as much as possible.

Prior presentations

The manuscript is not being reviewed elsewhere and it has not been published elsewhere either.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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